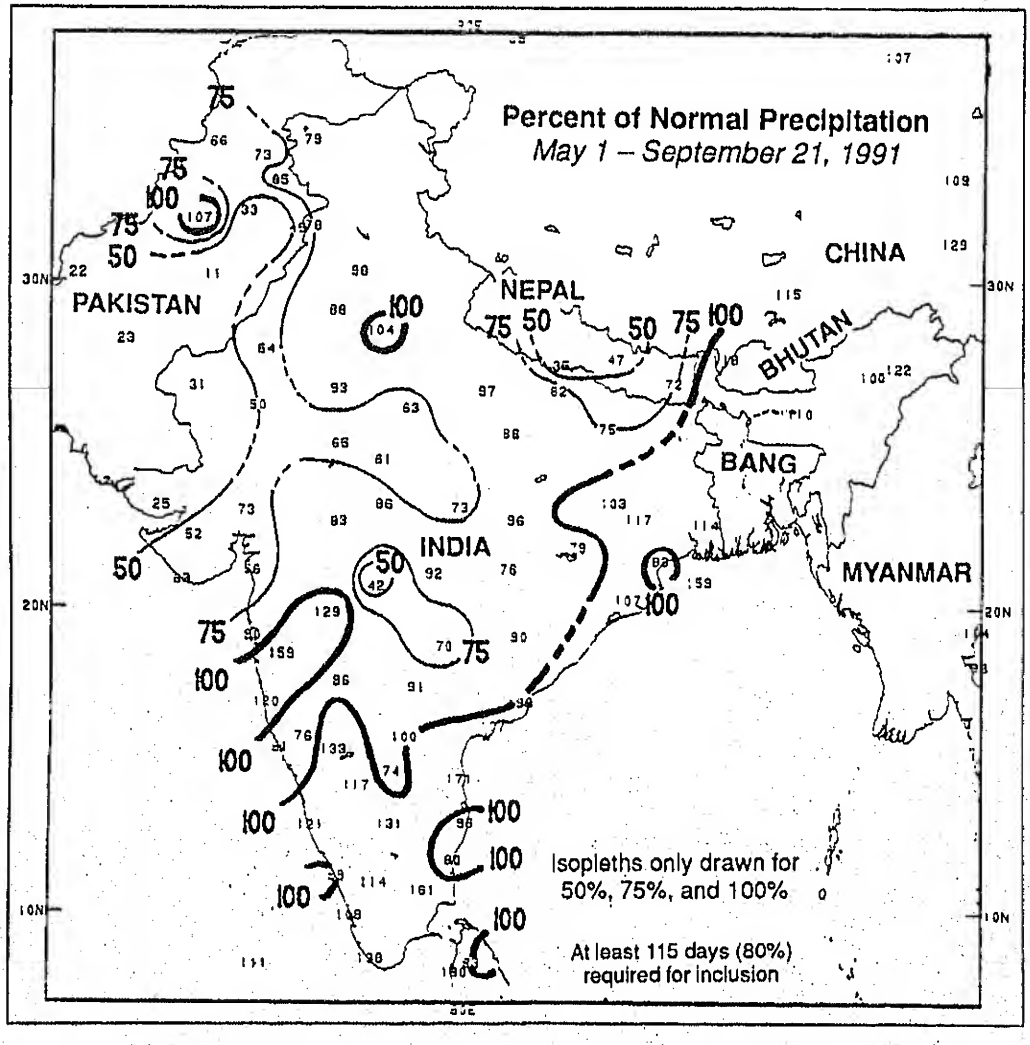
CONTAINS:
REVIEW OF THE 1991 INDIAN MONSOON

CLIMATE ANALYSIS CENTER

CONTAINS:
AUGUST AND SUMMER 1991 GLOBAL CLIMATE ANOMALIES

WEEKLY CLIMATE BULLETIN

No. 91/38 Washington, DC September 21, 1991



After a typical start to this year's monsoon in southern and eastern India and Bangladesh, the monsoon's northwestern advance slowed in mid-June, leaving most of Pakistan, western, central, and northern India, and Nepal abnormally dry. Despite sporadic rainfall in July and August, much of Pakistan, Nepal, Gujarat, Rajasthan, and parts of Madhya Pradesh and Mararashtra received less than 75 percent of normal since the first of May. In contrast, near to above normal rainfall dominated most of southern and eastern India. Although rainfall data in Bangladesh are lacking, press reports indicated that major flooding along the Ganges and Jamuna rivers left millions homeless and took hundreds of lives.

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE-NATIONAL METEOROLOGICAL CENTER
CLIMATE ANALYSIS CENTER

WEEKLY CLIMATE BULLETIN

This Bulletin is issued weekly by the Climate Analysis Center and is designed to indicate, in a brief concise format, current surface climatic conditions in the United States and around the world. The Bulletin contains:

- *Highlights of major climatic events and anomalies.*
- *U.S. climatic conditions for the previous week.*
- *U.S. apparent temperatures (summer) or wind chill (winter).*
- *Global two-week temperature anomalies.*
- *Global four-week precipitation anomalies.*
- *Global monthly temperature and precipitation anomalies.*
- *Global three-month precipitation anomalies (once a month).*
- *Global twelve-month precipitation anomalies (every three months).*
- *Global three-month temperature anomalies for winter and summer seasons.*
- *Special climate summaries, explanations, etc. (as appropriate).*

Most analyses contained in this Bulletin are based on preliminary, unchecked data received at the Climate Analysis Center via the Global Telecommunications System. Similar analyses based on final, checked data are likely to differ to some extent from those presented here.

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GLOBAL CLIMATE HIGHLIGHTS

MAJOR CLIMATIC EVENTS AND ANOMALIES AS OF SEPTEMBER 21, 1991

1. Alaska:

DRYNESS PERSISTS.

Near to above normal precipitation was observed in the northwestern portion of the state but dry weather continued over northeastern sections, where less than half of normal precipitation has fallen since mid-August [9 weeks].

2. Central and Eastern United States:

COLD WAVE BRINGS ABRUPT END TO ABNORMAL WARMTH.

A blast of cold Canadian air dropped temperatures to as much as 6°C below normal for the week in the Great Plains and Mississippi Valley, quickly ending the anomalous warmth that had persisted over the central United States. Temperatures remained above normal in the eastern states, where cool air moved in considerably later in the week. Departures exceeded +3°C in south-central Virginia [Ended after 5 weeks].

3. South-Central United States:

MORE HEAVY RAIN CAUSES FLOODING.

Heavy rain (100-225 mm in many areas) again brought minor to moderate flooding to parts of Oklahoma and northeastern Texas [12 weeks].

4. Northern Mexico:

TROPICAL STORM DOUSES REGION.

Torrential rain due to moisture from the remnants of Tropical Storm Ignacio caused several dams to burst in the state of Chihuahua, leaving 10,000 people homeless and taking at least 13 lives [Episodic Event].

5. The Azores:

DRIER WEATHER RETURNS

Little or no rain fell across the islands, decreasing moisture surpluses that had prevailed for several weeks [Ending after 3 weeks].

6. Central and Northwestern Europe:

SCATTERED RAINS BRING SOME RELIEF FROM EXTREME DRYNESS.

Moderate rains of 10-50 mm eased dryness in parts of Ireland, Scotland, southern Scandinavia, and north central Germany. Little or no rain, however, fell over much of the remainder of the area as large moisture deficits persisted. Precipitation shortfalls of 50 - 250 mm for the last 6 weeks have been measured across most of the region [7 weeks]. Weekly temperature departures of +3°C to +6°C above normal were reported from France and northern Spain to Hungary as abnormal hot conditions returned to the continent [8 weeks].

7. Southeast Asia:

HEAVY RAINS CONTINUE.

Although no rainfall reports are received from Cambodia, southeastern Thailand and southern Vietnam reported heavy rains of 100 - 200 mm. According to reports, over 1000 square kilometers of rice crops in Cambodia have been destroyed, but the water level along the Mekong River in Phnom Penh has fortunately remained below the dikes bordering the city. Heavy damage to roads, bridges, and homes has also been reported [7 weeks].

8. Northeastern China and Northern North Korea:

WIDESPREAD RAINS EASE DRYNESS.

Moderate to heavy rains of 30 - 125 mm fell across much of North Korea and central Heilungjiang while amounts of 10 - 40 mm covered much of the remainder of the area, relieving dryness that had enveloped the region for several weeks [Ending after 7 weeks].

9. Central and Southern Japan:

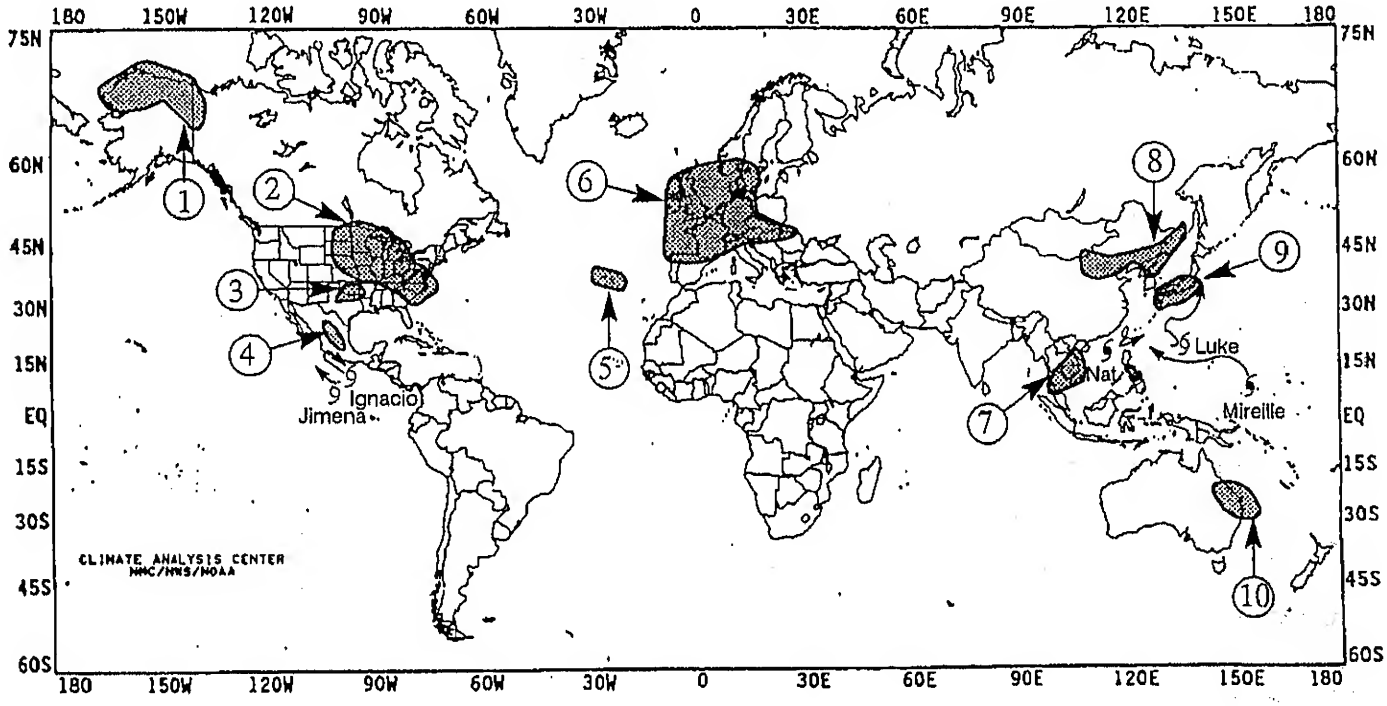
TROPICAL STORMS AND HEAVY RAIN CONTINUE TO BATTER REGION.

Tropical Storm Luke, with winds of up to 108 kph, dumped 100 - 200 mm of rain on central Japan (see page 6). Luke followed in the wake of Typhoons Kinna and Ivy, which pounded Japan the previous week [2 weeks].

10. East-Central Australia:

DRY WEATHER CONTINUES.

Little or no rain fell across the afflicted area as exceptionally dry weather persisted. Deficits exceeding 50 mm since early August prevailed throughout the region [8 weeks].



EXPLANATION

TEXT: Approximate duration of anomalies is in brackets. Precipitation amounts and temperature departures are this week's values.
MAP: Approximate locations of major anomalies and episodic events are shown. See other maps in this Bulletin for current two week temperature anomalies, four week precipitation anomalies, long-term anomalies, and other details.

UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF SEPTEMBER 15 – 21, 1991

The transition from Summer to Fall came abruptly as a late summer heat wave in the eastern third of the nation gave way to a strong blast of Canadian air across the central U.S. The progression was marked by record heat and severe weather in the East, record cold in the nation's midsection, and snowfall in the Rockies and upper Midwest. As many as 6 dozen record daily highs were established from the Deep South to northern New England as readings soared above 90°F with some locations reporting the highest temperatures ever recorded so late in a year. High humidities, in addition to the heat yielded apparent temperatures up to 105°F in Virginia and Georgia. Farther west, sharply colder weather moved into the central U.S. where almost 50 daily record lows were registered on Thursday morning. In addition, numerous locations in Indiana and Illinois observed the coldest readings for so early into the Fall season. Both Burlington, IA and Peoria, IL recorded the first-ever occurrence of a freezing temperature in the astronomical summer season. Meanwhile, the earliest and greatest September total snowfall transpired at Duluth, MN on Wednesday, when nearly 2.5 inches coated the ground. Elsewhere, strong thunderstorms saturated parts of Texas with over 8 inches of rain, swelling rivers, and causing flash floods that washed-out bridges, flooded roads, and forced evacuations. In contrast, dry and warm conditions complicated firefighters efforts to contain a blaze that charred 1200 acres in the Shasta-Trinity National Forest, according to press reports. Farther north, heavy rains soaked southern Alaska with over 12 inches of precipitation measured at Yakutat.

The first half of the week commenced with record heat gripping the eastern U.S. as warm, moist air circulated northward on the western side of a high pressure system off the East Coast. Readings approaching 100°F were observed in the mid-Atlantic as dozens of record daily highs were reported from Alabama to Connecticut. On Tuesday, Greer, SC recorded a seventh consecutive day of record highs while the high of 95°F at Newark, NJ was the warmest reading for so late in a year. Farther west, a strong cold front ushered in sharply colder conditions across the northern Plains and Rockies. Winds gusted to 50 mph as the front trekked through the Dakotas. To the south, slow-moving thunderstorms battered the southern Plains. Brief and torrential rains affected portions of Texas and Oklahoma. Bethany, OK was inundated with nearly an inch of rain in 8 minutes while Benbrook, TX was soaked with 3 inches in 45 minutes, leaving several roads flooded.

During the last half of the week, the front in the Great Plains continued to sweep eastward. Colder air overspread much of the Plains and Mississippi Valley by Wednesday as record daily lows were reported from Minnesota to Nebraska and readings dipped into the twenties. Thunderstorms popped up along and ahead of the front, generating copious amounts of rain in northern Texas. Lubbock, TX was drenched with a half a foot of rain, causing flash floods that left some roads under 3 feet of water. Meanwhile, hot weather continued to bake the East. High humidity and heat produced oppressive conditions in the mid-Atlantic and Southeast. The sultry weather fueled strong thunderstorms that produced heavy rain, hail, and strong wind gusts. Hot weather also affected interior California and southern Oregon with readings exceeding 100°F at several locations. By the weekend, the cold front in the eastern half of the U.S. pushed off the Atlantic Coast, bringing an end to the abnormally warm weather. The record heat was replaced by unseasonably cool conditions and record daily lows as far south as South Carolina.

According to the River Forecast Centers, the greatest weekly totals (more than 2 inches) occurred from south-central Texas northeastward to southern Missouri, across southern Florida, northern New England, southern Alaska, eastern Hawaii, and scattered locations in the mid-Atlantic, the central Gulf Coast, and the northern Plains (Table 1). Light to moderate amounts were measured across the remainder of New England, the mid-Atlantic, the South, most of the Ohio and Mississippi Valleys, most of the northern and southern Great Plains and Rockies, western Alaska, and the remainder of the Hawaiian Islands. Little or no precipitation fell from southern Indiana to central Michigan, across northern Florida and Alabama, the central Plains and Rockies, Great Basin, Far West and central Alaska.

Unseasonably warm conditions prevailed in the eastern and western quarters of the nation (Table 2). Weekly departures between +4°F and +6°F were common in the mid-Atlantic and Far West as readings soared near 100°F in Virginia, Maryland, southern Oregon and interior California. Temperatures averaged more than 2°F above normal from northern Florida to northern Maine and across much of the Far West. Near to slightly above normal temperatures were observed in the eastern Great Lakes and Ohio Valley despite a late-week blast of cold Canadian air. In Alaska, unusually mild conditions engulfed most of the state. Weekly departures up to +7°F were recorded in the central portions where highs during the week reached 70°F. Weekly departures between +2°F and +6°F were common across the remainder of the state.

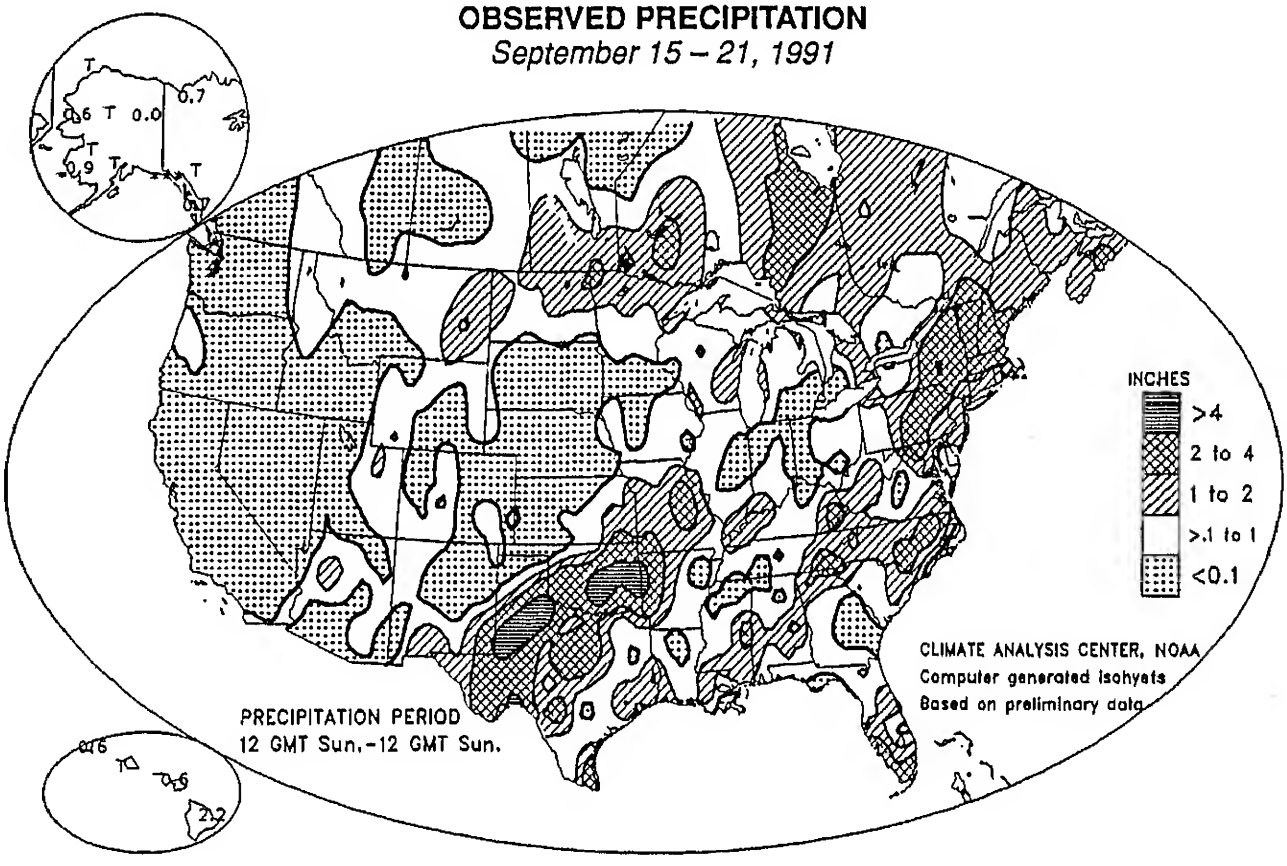
Sharply colder weather gripped much of the central U.S. (Table 3). Weekly departures between –9°F and –13°F were recorded from the Rio Grande Valley to the northern Great Plains where lows dropped into the teens and twenties. Departures of –2°F to –8°F were common from the Rockies eastward into the central Ohio Valley with freezing temperatures reported as far south as southern Nebraska. Near to slightly below normal temperatures were limited to the Tennessee and lower Mississippi Valleys, southern and coastal California, and a few locations in southern Alaska.

TABLE 1. *SELECTED STATIONS WITH 2.75 OR MORE INCHES OF PRECIPITATION DURING THE WEEK OF SEPTEMBER 15 – 21, 1991*

STATION	TOTAL (INCHES)	STATION	TOTAL (INCHES)
YAKUTAT, AK	12.41	MIDLAND, TX	3.32
LUBBOCK, TX	4.72	STEPHENVILLE, TX	3.30
CORDOVA/MILE 13, AK	4.53	OK CITY/TINKER AFB, OK	3.22
FT MYERS, FL	4.47	OKLAHOMA CITY, OK	3.12
MCALESTER, OK	3.76	LUBBOCK/REESE AFB, TX	3.05
TULSA, OK	3.68	DEVIL'S LAKE, ND	2.99
UTICA, NY	3.65	KILLEEN/ROBERT-GRAY AFB, TX	2.82
BATON ROUGE, LA	3.63	MERIDIAN, MS	2.81
FT SMITH, AR	3.55	CHICOPEE/WESTOVER AFB, MA	2.80
JUNEAU, AK	3.33		

OBSERVED PRECIPITATION

September 15 – 21, 1991



DEPARTURE OF AVERAGE TEMPERATURE FROM NORMAL (°F)

September 15 – 21, 1991

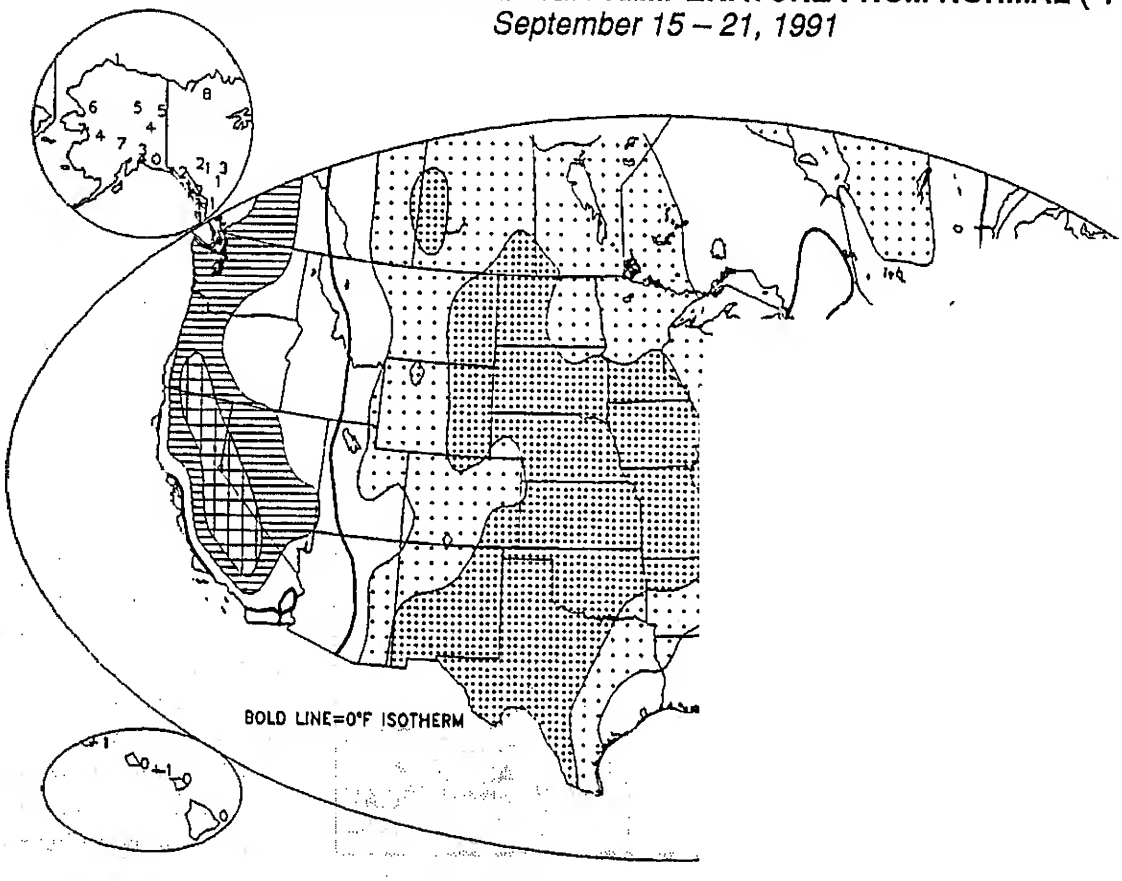


TABLE 2. *SELECTED STATIONS WITH TEMPERATURES AVERAGING 6.0°F OR MORE ABOVE NORMAL FOR THE WEEK OF SEPTEMBER 15 - 21, 1991*

STATION	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
BLUE CANYON, CA	+10.7	73.1	MEDFORD, OR	+6.7	71.3
SEXTON SUMMIT, OR	+8.7	67.9	POUGHKEEPSIE, NY	+6.5	68.6
VICTORVILLE/GEORGE AFB, CA	+8.6	79.8	RED BLUFF, CA	+6.4	81.1
MT SHASTA, CA	+8.2	68.7	KOTZEBUE, AK	+6.2	46.9
RENO, NV	+7.6	67.3	BAKERSFIELD, CA	+6.1	83.1
FRESNO, CA	+7.3	81.0	SAN BERNARDINO/NORTON AFB, CA	+6.1	78.6
MCGRATH, AK	+7.0	50.1	RICHMOND/BYRD, VA	+6.1	75.6
BIG DELTA, AK	+7.0	50.0	PORTLAND, OR	+6.0	68.2
NOME, AK	+7.0	48.5			

TABLE 3. *SELECTED STATIONS WITH TEMPERATURES AVERAGING 9.0°F OR MORE BELOW NORMAL FOR THE WEEK OF SEPTEMBER 15 - 21, 1991*

STATION	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
CARLSBAD, NM	-12.8	60.6	ABILENE, TX	-9.9	65.6
WINK, TX	-12.5	62.5	AMARILLO, TX	-9.8	59.2
TUCUMCARI, NM	-12.4	56.7	GILLETTE, WY	-9.7	48.9
LUBBOCK, TX	-11.6	59.1	COLUMBIA, MO	-9.7	58.7
CLOVIS/CANNON AFB, NM	-11.5	56.9	JOPLIN, MO	-9.5	60.7
MIDLAND, TX	-10.9	62.6	OTTUMWA, IA	-9.2	55.6
ROSWELL, NM	-10.7	59.7	KANSAS CITY/INTL, MO	-9.2	60.0
EL PASO, TX	-10.3	64.1	WICHITA FALLS, TX	-9.1	66.5
FT SILL/HENRY POST AAF, OK	-10.1	64.9	ELKHART, KS	-9.0	59.3
SAN ANGELO, TX	-10.0	65.6	ENID/VANCE AFB, OK	-9.0	64.4

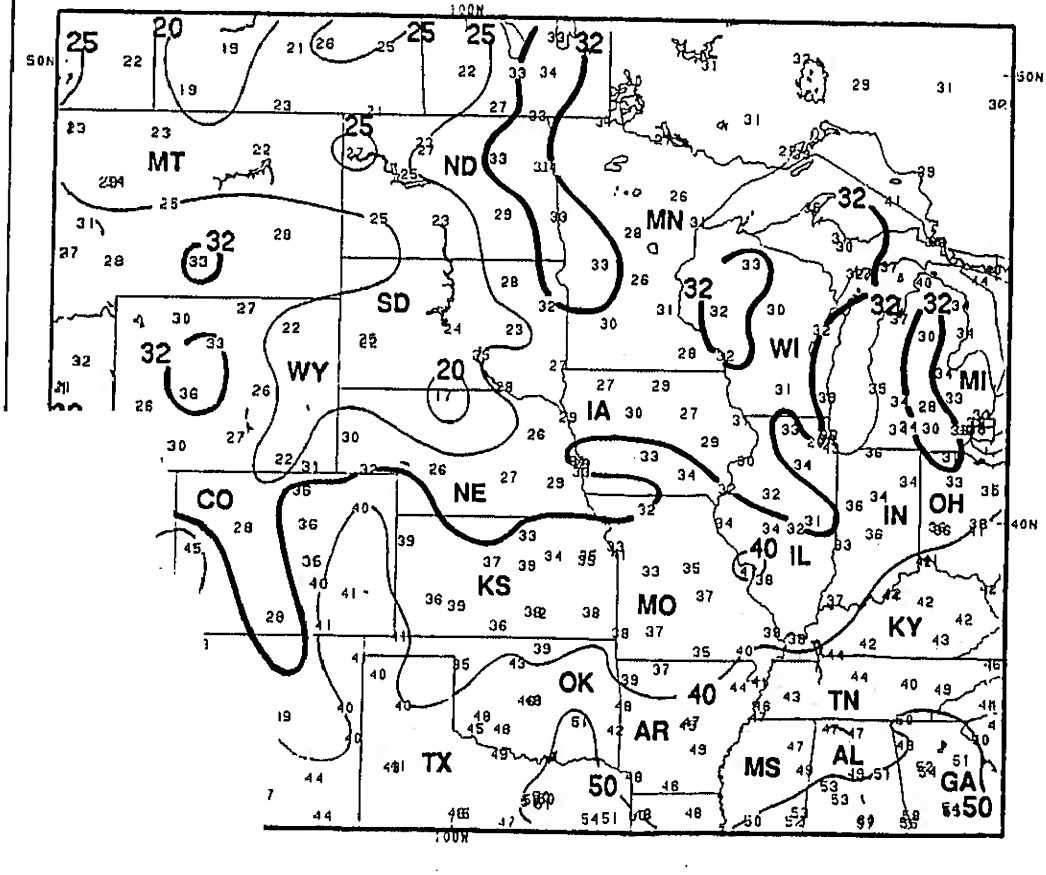
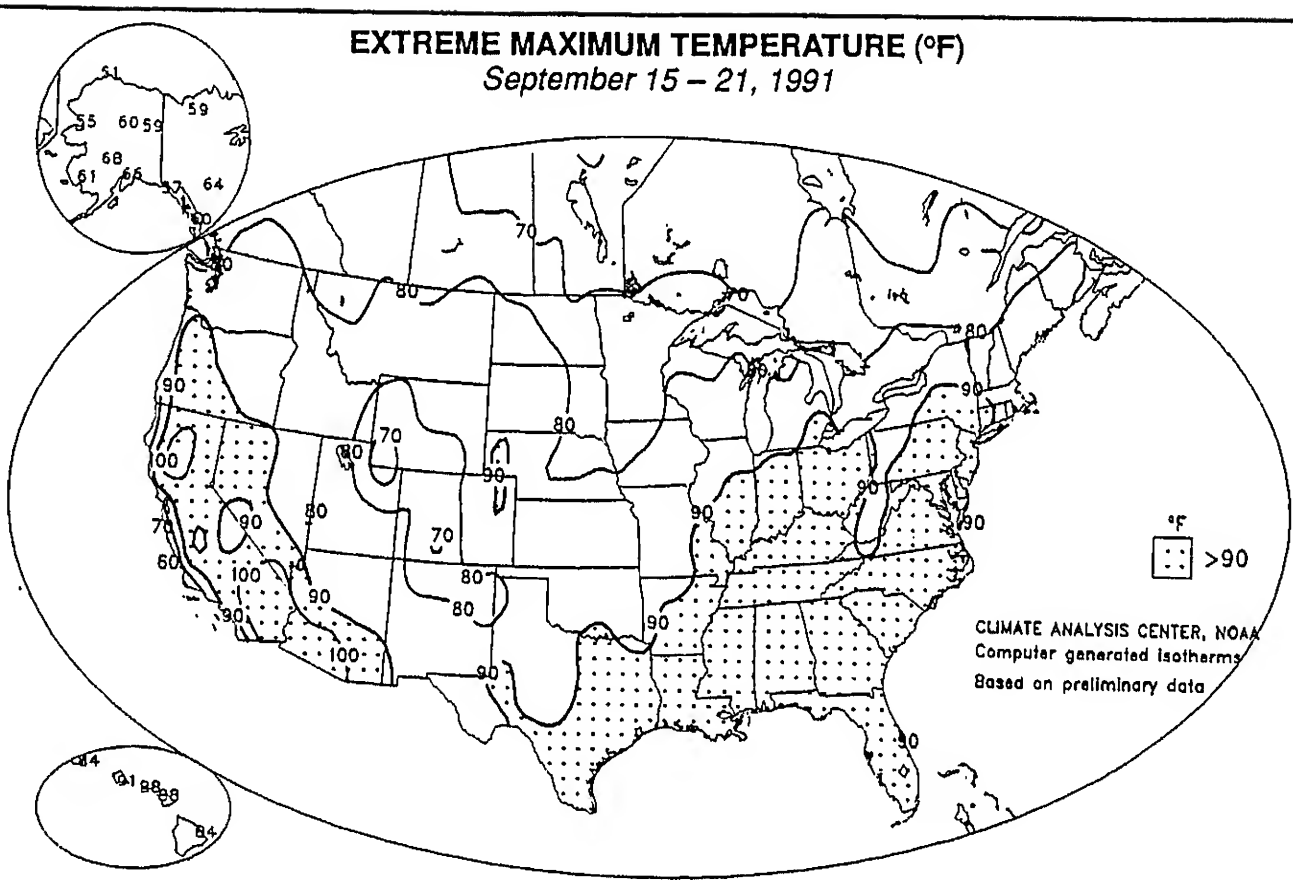


FIGURE 1. Extreme Minimum Temperature for September 15 - 21, 1991. *Isopleths drawn only for 20°F, 25°F, 32°F, 40°F, and 50°F. Frigid Canadian air blasted into the nation's midsection at the end of summer replacing the abnormal warmth of the previous weeks (see Weekly Climate Bulletin, #91/37, page 4, Sept. 14, 1991). Temperatures plunged below freezing in the central Plains and northern Corn Belt, damaging some late maturing crops. More than two dozen record low temperatures were set or tied on the 20th from Minnesota southward to Texas and eastward to West Virginia.*

EXTREME MAXIMUM TEMPERATURE (°F)

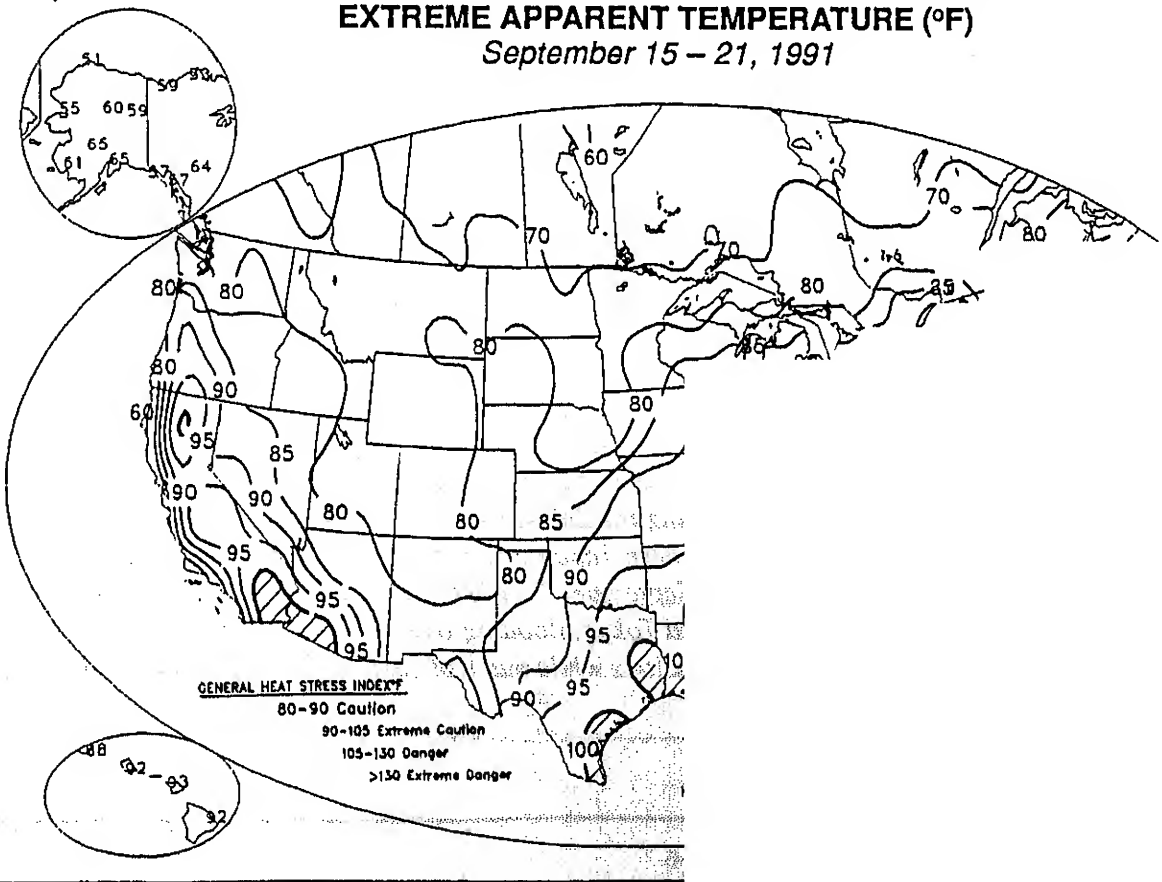
September 15 – 21, 1991



Abnormally warm weather affected a large portion of the East and Far West as highs exceeded 90°F (top). Oppressive heat and humidity produced apparent temperatures over 100°F in the deep South, mid-Atlantic, and parts of the Southwest (bottom).

EXTREME APPARENT TEMPERATURE (°F)

September 15 – 21, 1991



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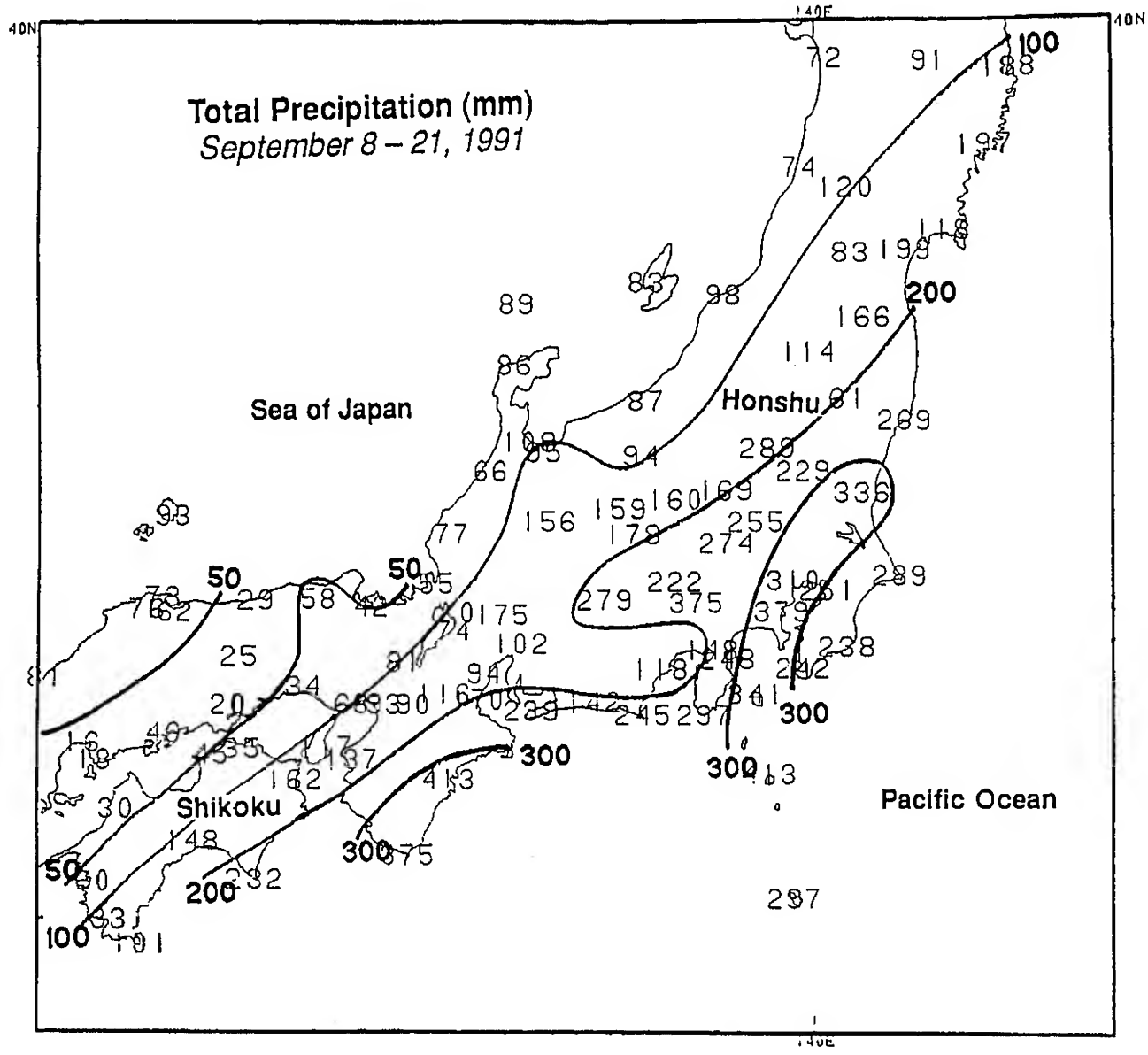
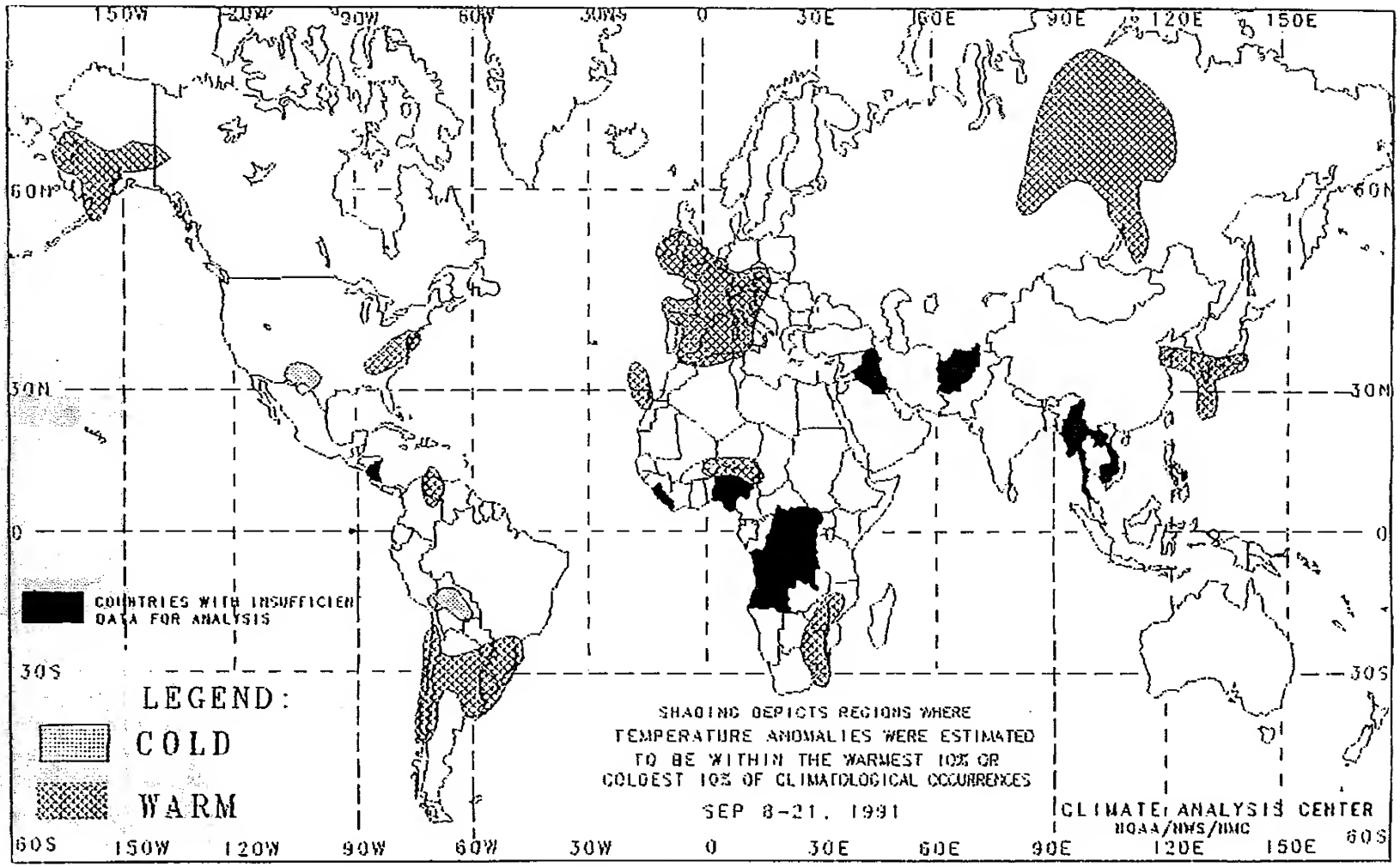


In on the 20th of September with severe wind and heavy 8,000 homes, and triggering devastating landslides. rain, the most rain in 24 hours during the last 20 years. Most transportation services were disrupted, including the Shinkansen bullet trains. Luke struck in the wake of Typhoon Kinna, which left 9 people dead in southern Japan and brought heavy rain to much of Japan's Pacific coast (see Weekly Climate Bulletin. #91/37, September 14, 1991, page 1). Heavy rains associated with Typhoon Ivy (just days before Kinna) also inundated Tokyo, flooding over 500 dwellings. The three storms combined to dump over 400 mm of rain on some locations while much of eastern Honshu received more than 200 mm during the two week period.

2–WEEK GLOBAL TEMPERATURE ANOMALIES

SEPTEMBER 8 – 21, 1991



The anomalies on this chart are based on approximately 2500 observing stations for which at least 13 days of temperature observations were received from synoptic reports. Many stations do not operate on a twenty–four hour basis so many night time observations are not taken. As a result of these missing observations the estimated minimum temperature may have a warm bias. This in turn may have resulted in an overestimation of the extent of some warm anomalies.

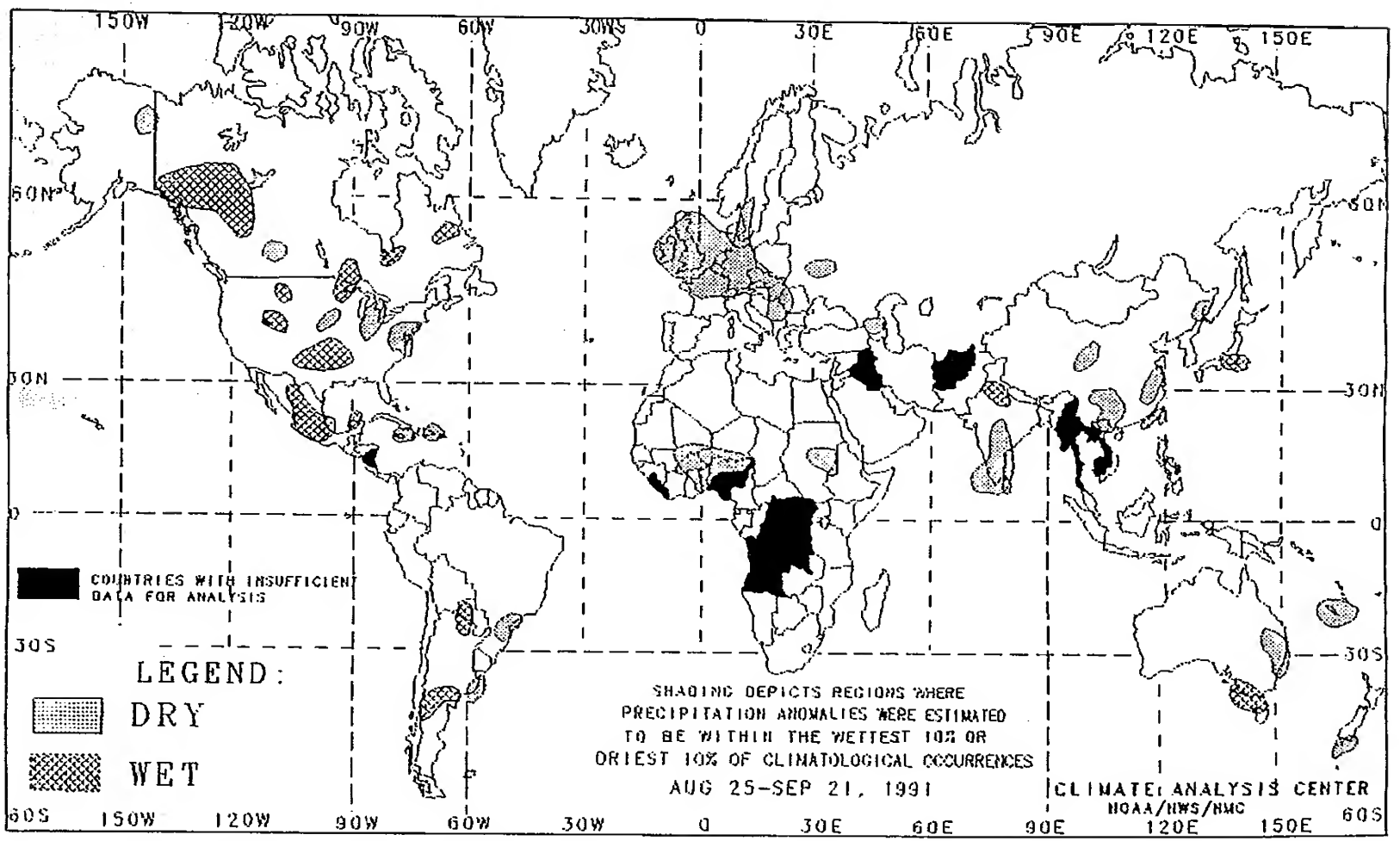
Temperature anomalies are not depicted unless the magnitude of temperature departures from normal exceeds 1.5°C.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

This chart shows general areas of two week temperature anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

4–WEEK GLOBAL PRECIPITATION ANOMALIES

AUGUST 25 – SEPTEMBER 21, 1991



The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

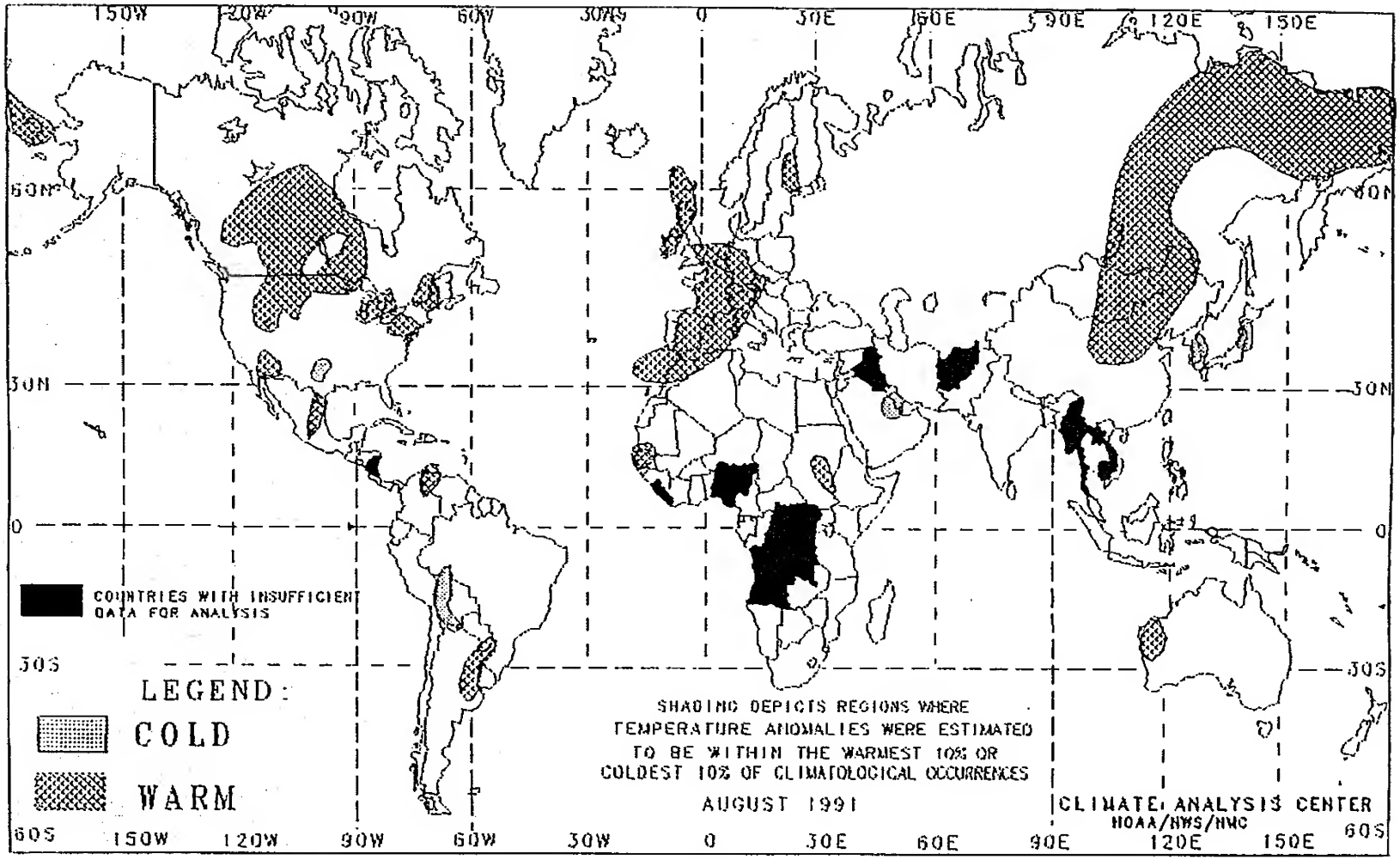
In climatologically arid regions where normal precipitation for the four week period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total four week precipitation exceeds 50 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of four week precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

MONTHLY GLOBAL TEMPERATURE ANOMALIES

AUGUST 1991



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This chart shows general areas of one month temperature anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

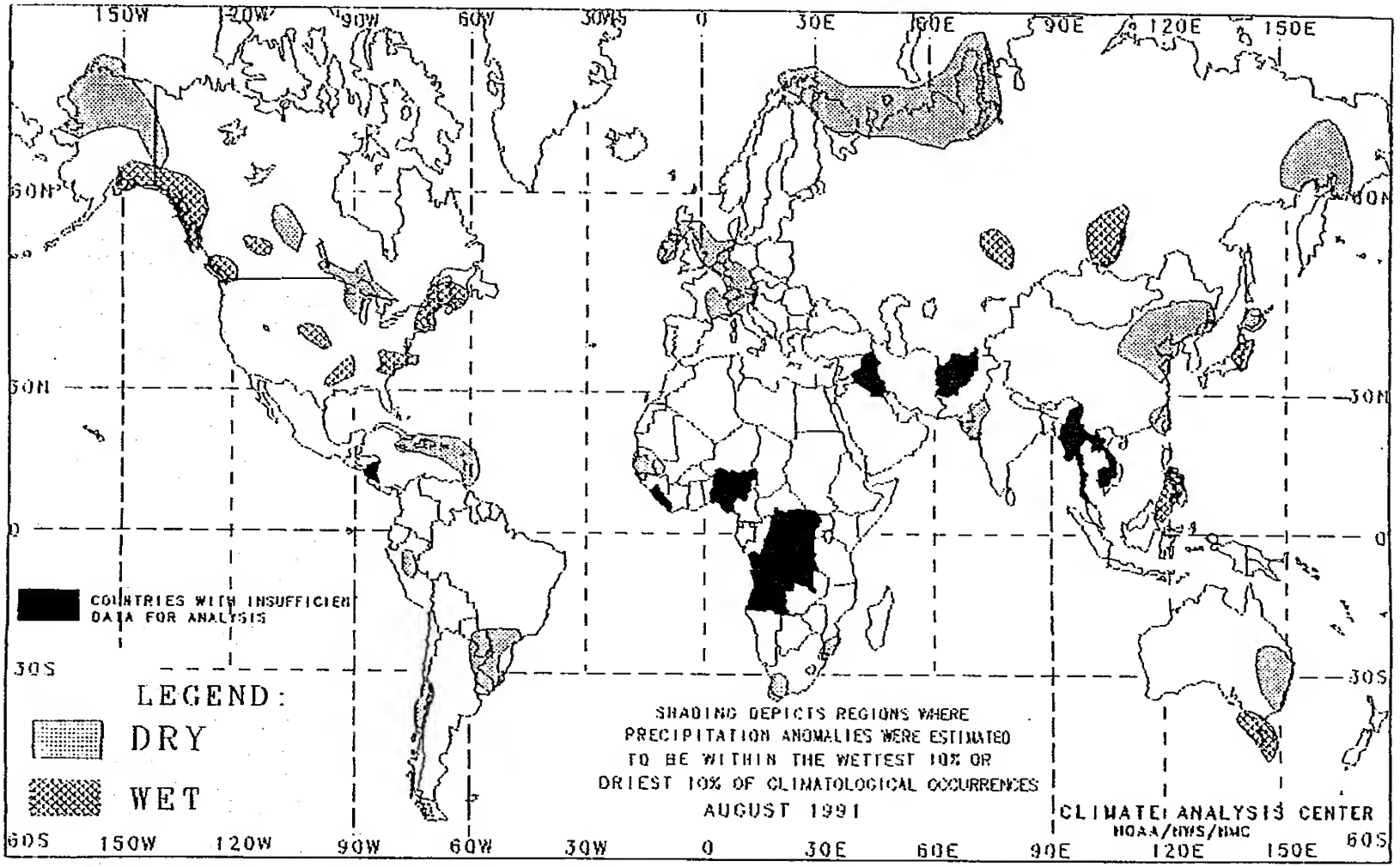
PRINCIPAL TEMPERATURE ANOMALIES

AUGUST 1991

REGIONS AFFECTED	TEMPERATURE AVERAGE (°C)	DEPARTURE FROM NORMAL (°C)	COMMENTS
NORTH AMERICA			
South–Central Canada and North–Central United States	+14 to +26	+2 to +4	WARM – 2 to 10 weeks
Arizona	Around +35	+2 to +3	WARM – 2 to 4 weeks
Wisconsin, Michigan, and Ontario	+20 to +23	Around +2	Very warm second half of August
Pennsylvania and New York	+23 to +26	Around +2	Very warm second half of August
Northern New England and South–Central Quebec	+19 to +21	Around +2	Very warm second half of August
North–Central Texas	+26 to +27	Around –2	Very cool first half of August
North–Central Mexico	+21 to +30	Around +2	WARM – 4 weeks
SOUTH AMERICA AND EASTERN PACIFIC			
Western Venezuela	+22 to +33	+2 to +4	WARM – 2 to 5 weeks
Western Bolivia	+6 to +23	–2 to –3	Very cool first half of August
Northeastern Argentina	+12 to +19	Around +2	Very warm second half of August
EUROPE AND THE MIDDLE EAST			
Ireland and Scotland	+12 to +17	Around +2	WARM – 2 to 7 weeks
Western Europe	+4 to +26	+2 to +4	WARM – 2 to 10 weeks
Southwestern Finland	+16 to +17	Around +2	WARM – 4 to 5 weeks
Saudi Arabia and Bahrain	+32 to +34	Around –2	COOL – 4 weeks
AFRICA			
Morocco and Algeria	+24 to +30	Around +2	WARM – 2 to 5 weeks
Northern Senegal	+30 to +32	+2 to +3	WARM – 2 to 4 weeks
Central Sudan	+28 to +29	+2 to +4	WARM – 4 weeks
ASIA			
Eastern Soviet Union and Northeastern China	+5 to +27	+2 to +6	WARM – 2 to 14 weeks
Northern Honshu, Japan	+20 to +22	Around –2	Very cool first half of August
South Korea	+22 to +24	Around –2	Very cool first half of August
AUSTRALIA AND WESTERN PACIFIC			
Northwestern Australia	+16 to +21	Around +2	Very warm first half of August

MONTHLY GLOBAL PRECIPITATION ANOMALIES

AUGUST 1991



The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the one month period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total one month precipitation exceeds 50 mm.

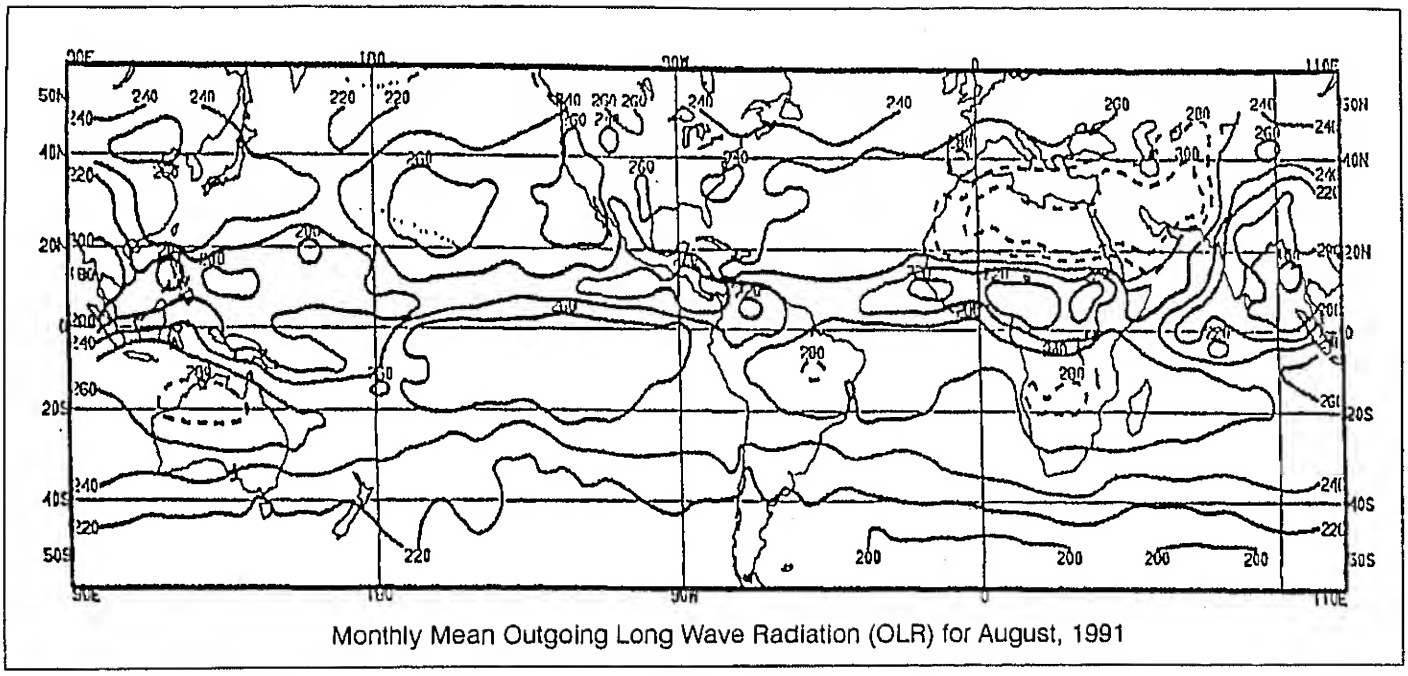
In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of one month precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

PRINCIPAL PRECIPITATION ANOMALIES

AUGUST 1991

REGIONS AFFECTED	PRECIPITATION TOTAL (MM)	PERCENT OF NORMAL	COMMENTS
NORTH AMERICA			
Northern and Central Alaska	0 to 19	0 to 32	DRY – 5 to 16 weeks
Southeastern Alaska and West–Central Canada	90 to 188	156 to 338	Heavy precipitation second half of August
Southwestern British Columbia	70 to 216	236 to 414	WET – 6 to 10 weeks
Southeastern British Columbia	109 to 123	188 to 227	Heavy precipitation first half of August
Southern Alberta	11 to 22	24 to 34	DRY – 5 to 13 weeks
Northern Great Lakes Region	6 to 21	8 to 29	DRY – 5 to 9 weeks
Maritime Provinces and New England	150 to 535	170 to 545	WET – 4 to 5 weeks
Southeastern United States	156 to 335	176 to 237	WET – 5 to 8 weeks
South–Central United States	183 to 234	276 to 374	WET – 2 to 14 weeks
Central United States	94 to 192	211 to 266	WET – 2 to 5 weeks
Caribbean Islands	14 to 72	15 to 45	DRY – 5 to 10 weeks
SOUTH AMERICA AND EASTERN PACIFIC			
Central Peru	6 to 18	6 to 18	DRY – 9 to 10 weeks
East–Central South America	0 to 25	0 to 24	DRY – 5 to 10 weeks
Central Chile and Adjacent Argentina	1 to 93	3 to 30	DRY – 6 weeks
EUROPE AND THE MIDDLE EAST			
West–Central Europe	1 to 61	1 to 44	DRY – 4 to 10 weeks
Northern Scandinavia and Northern European Soviet Union	3 to 21	7 to 36	DRY – 5 to 10 weeks
AFRICA			
Western Sahel	18 to 183	20 to 51	DRY – 4 to 18 weeks
Southern Mozambique	1 to 3	3 to 9	DRY – 8 to 10 weeks
Southwestern South Africa	2 to 31	10 to 47	DRY – 4 weeks
ASIA			
Southwestern Siberia	111 to 166	208 to 262	Heavy precipitation first half of August
Vicinity of Lake Baykal, Soviet Union	97 to 173	155 to 202	WET – 4 to 5 weeks
Eastern Siberia	3 to 14	6 to 30	DRY – 10 to 13 weeks
Northeastern China	4 to 48	3 to 39	DRY – 5 to 10 weeks
Hokkaido, Japan	29 to 35	17 to 33	DRY – 5 to 9 weeks
Northern Honshu, Japan	317 to 358	184 to 234	WET – 2 to 5 weeks
Taiwan and Southeastern China	39 to 152	16 to 34	WET – 5 to 6 weeks
Northwestern India	3 to 136	4 to 47	DRY – 14 weeks
AUSTRALIA AND WESTERN PACIFIC			
Philippines and Northern Borneo	383 to 943	166 to 226	WET – 2 to 4 weeks
East–Central Australia	0 to 19	0 to 25	DRY – 7 to 10 weeks
Southeastern Australia	143 to 356	149 to 268	WET – 4 to 10 weeks

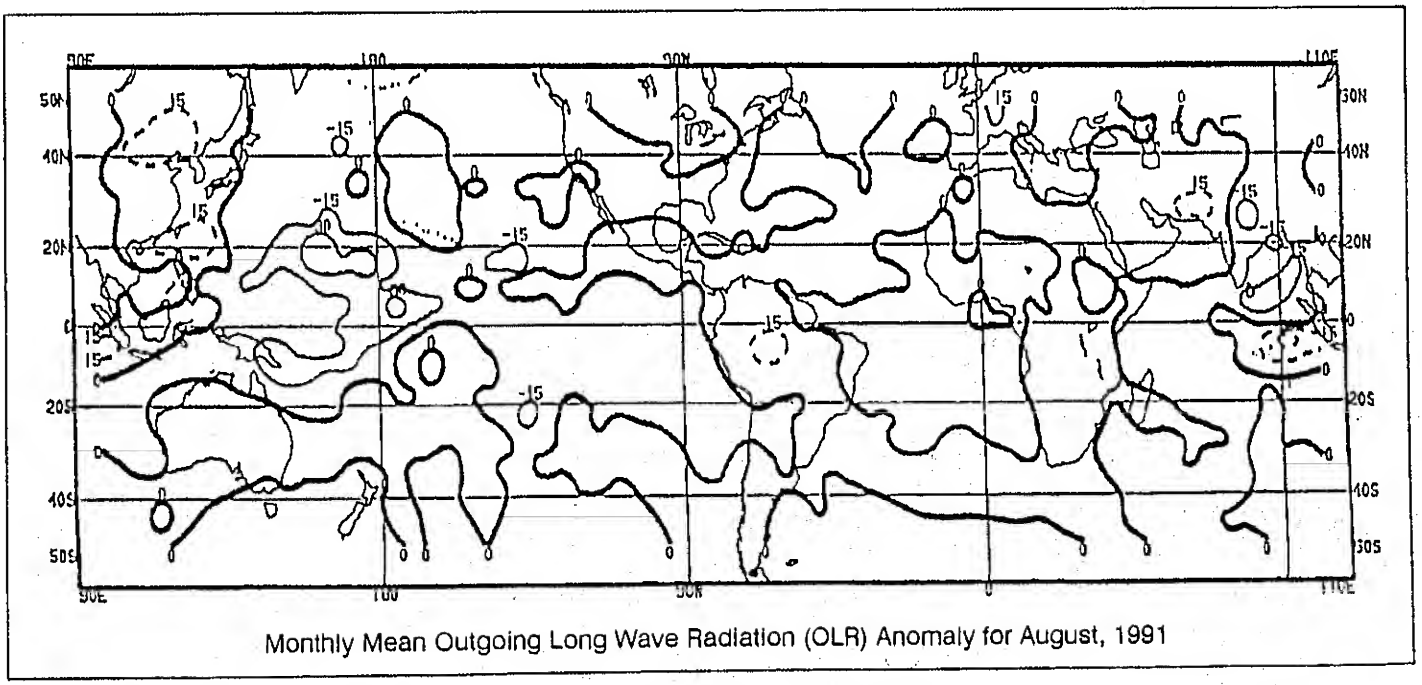


Monthly Mean Outgoing Long Wave Radiation (OLR) for August, 1991

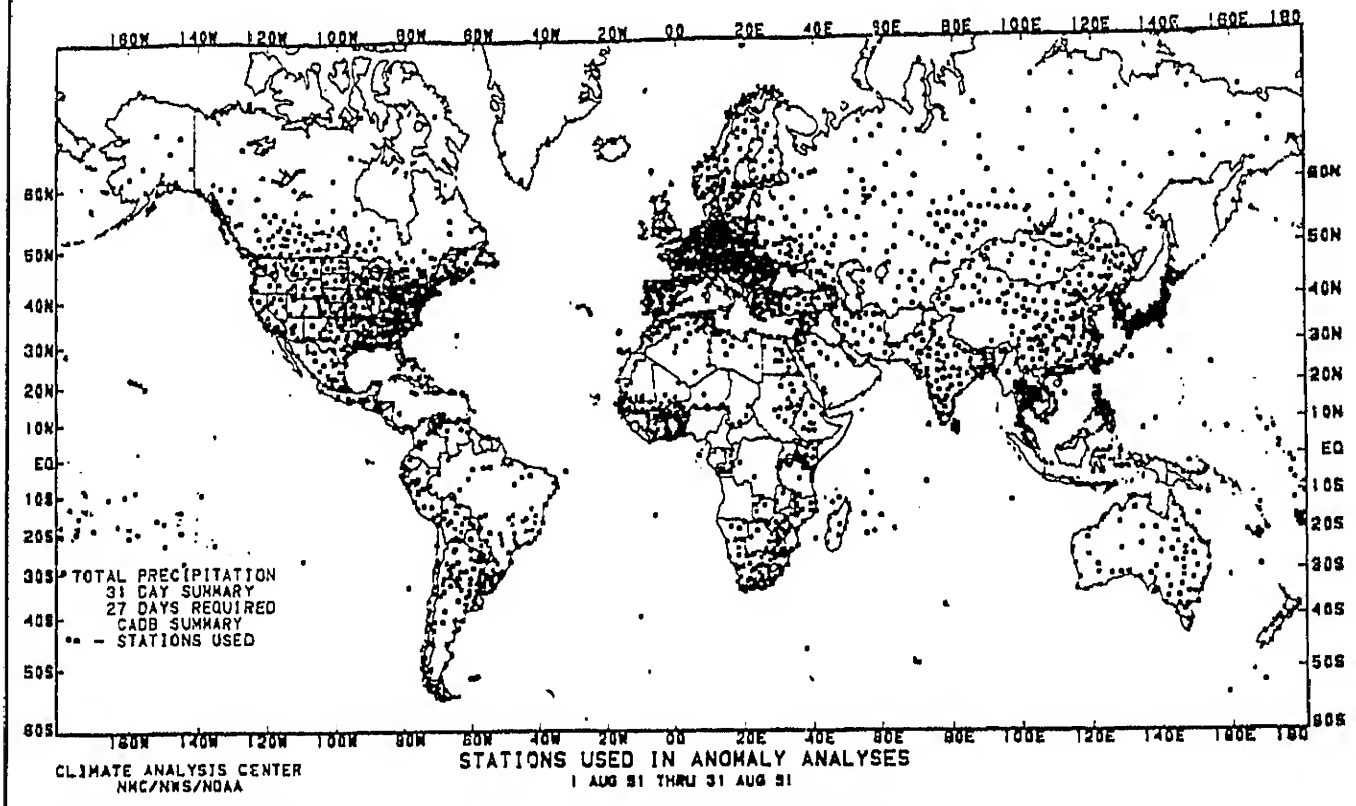
EXPLANATION

The mean monthly outgoing long wave radiation (OLR) as measured by the NOAA-9 AVHRR IR window channel by NESDIS/SRL (top). Data are accumulated and averaged over 2.5° areas to a 5° Mercator grid for display. Contour intervals are 20 Wm^{-2}, and contours of 280 Wm^{-2} and above are dashed. In tropical areas (for our purposes 20°N - 20°S) that receive primarily convective rainfall, a mean OLR value of less than 200 Wm^{-2} is associated with significant monthly precipitation, whereas a value greater than 260 Wm^{-2} normally indicates little or no precipitation. Care must be used in interpreting this chart at higher latitudes, where much of the precipitation is non-convective, or in some tropical coastal or island locations, where precipitation is primarily orographically induced. The approximate relationship between mean OLR and precipitation amount does not necessarily hold in such locations.

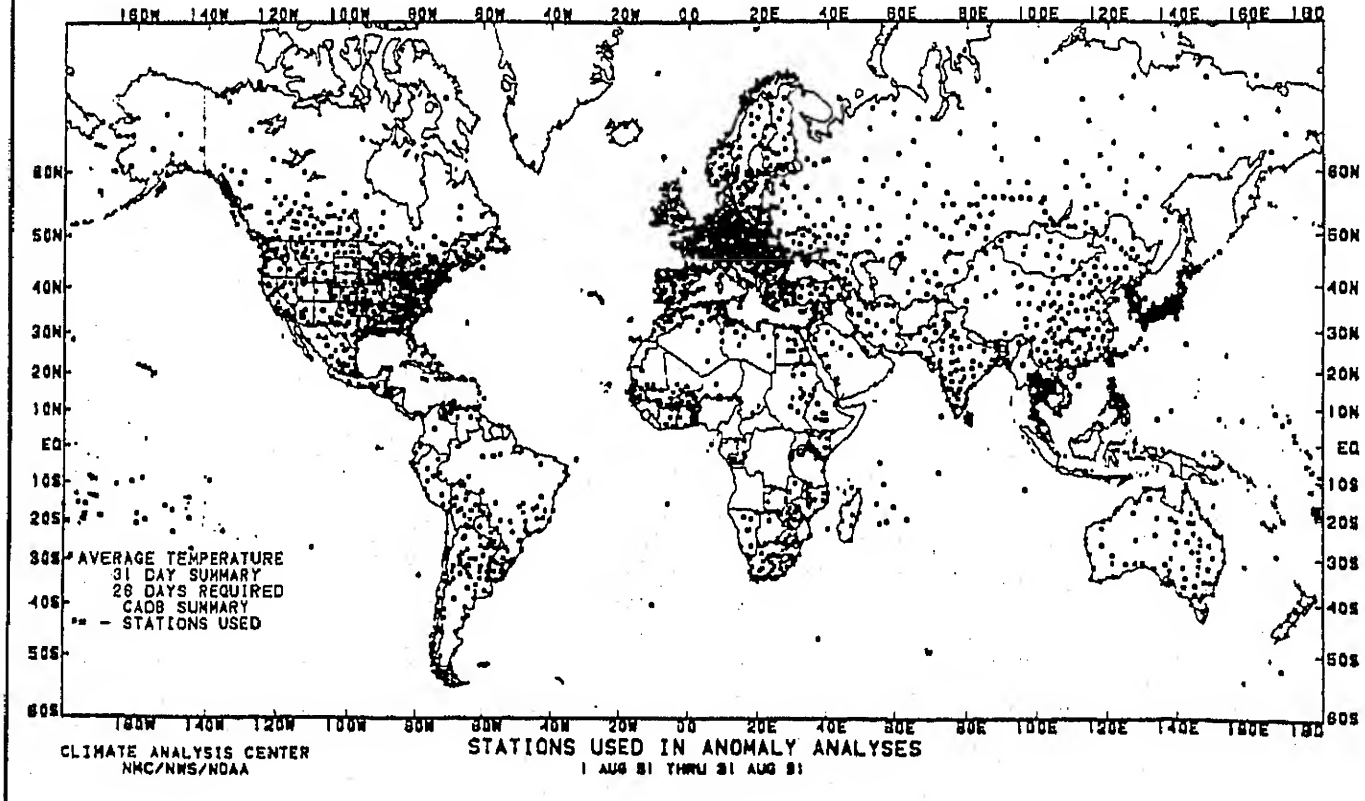
The mean monthly outgoing long wave radiation anomalies (bottom) are computed as departures from the 1979 - 1988 base period mean. Contour intervals are 15 Wm^{-2}, while positive anomalies (greater than normal OLR, suggesting less than normal cloud cover and/or precipitation) are dashed and negative anomalies (less than normal OLR, suggesting greater than normal cloud cover and/or precipitation) are solid.

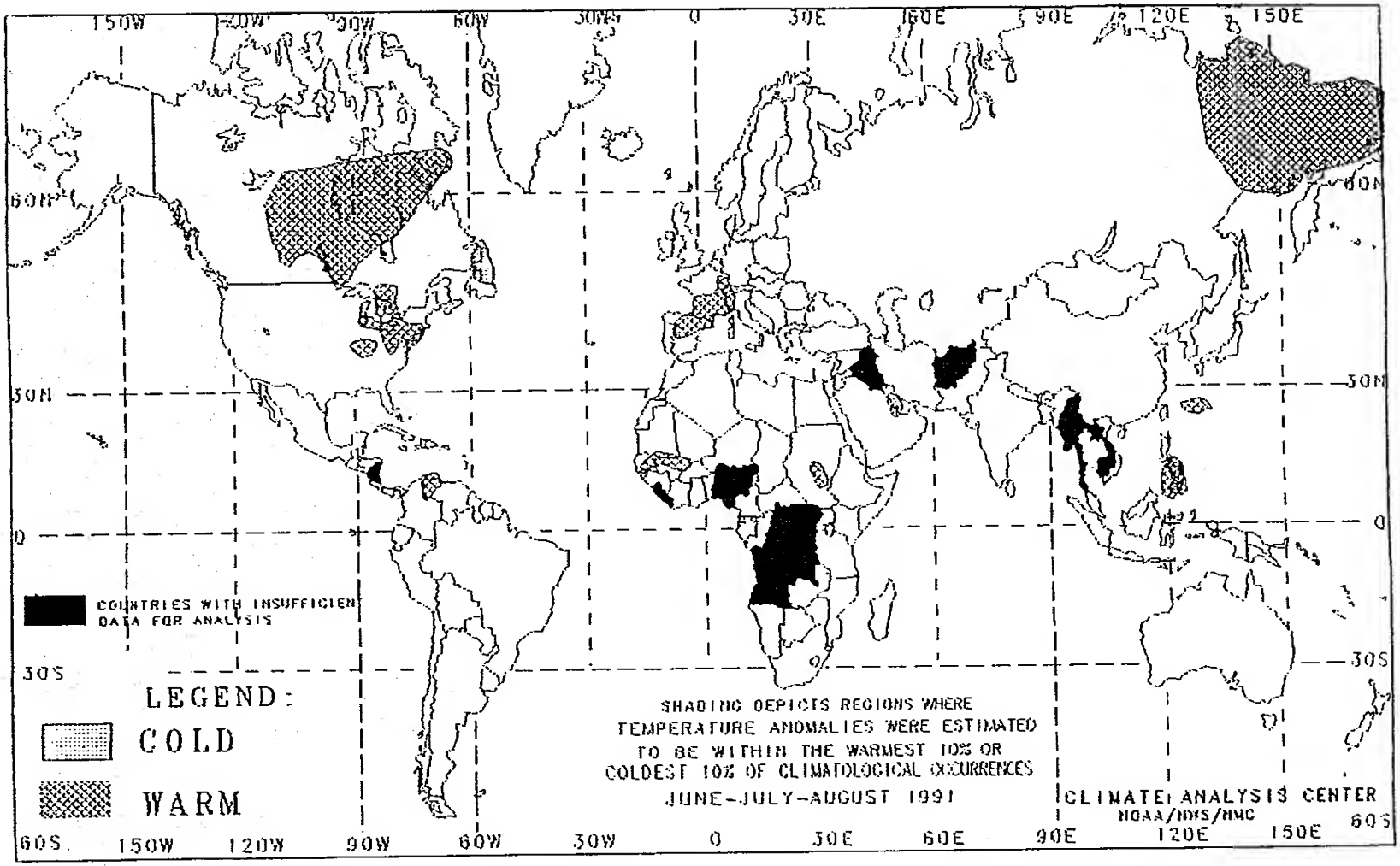


Monthly Mean Outgoing Long Wave Radiation (OLR) Anomaly for August, 1991



Stations used in the August 1991 anomaly analyses for total precipitation (top) and average temperature (bottom). 27 [26] days were required for inclusion in the monthly total precipitation [average temperature] anomaly analysis. There were insufficient or no data receipts for a few countries in Africa, the Middle East, and Southeast Asia.





The anomalies on this chart are based on approximately 2500 observing stations for which at least 78 days of temperature observations were received from synoptic reports. Many stations do not operate on a twenty–four hour basis so many night time observations are not taken. As a result of these missing observations the estimated minimum temperature may have a warm bias. This in turn may have reulted in an overestimation of the extent of some warm anomalies.

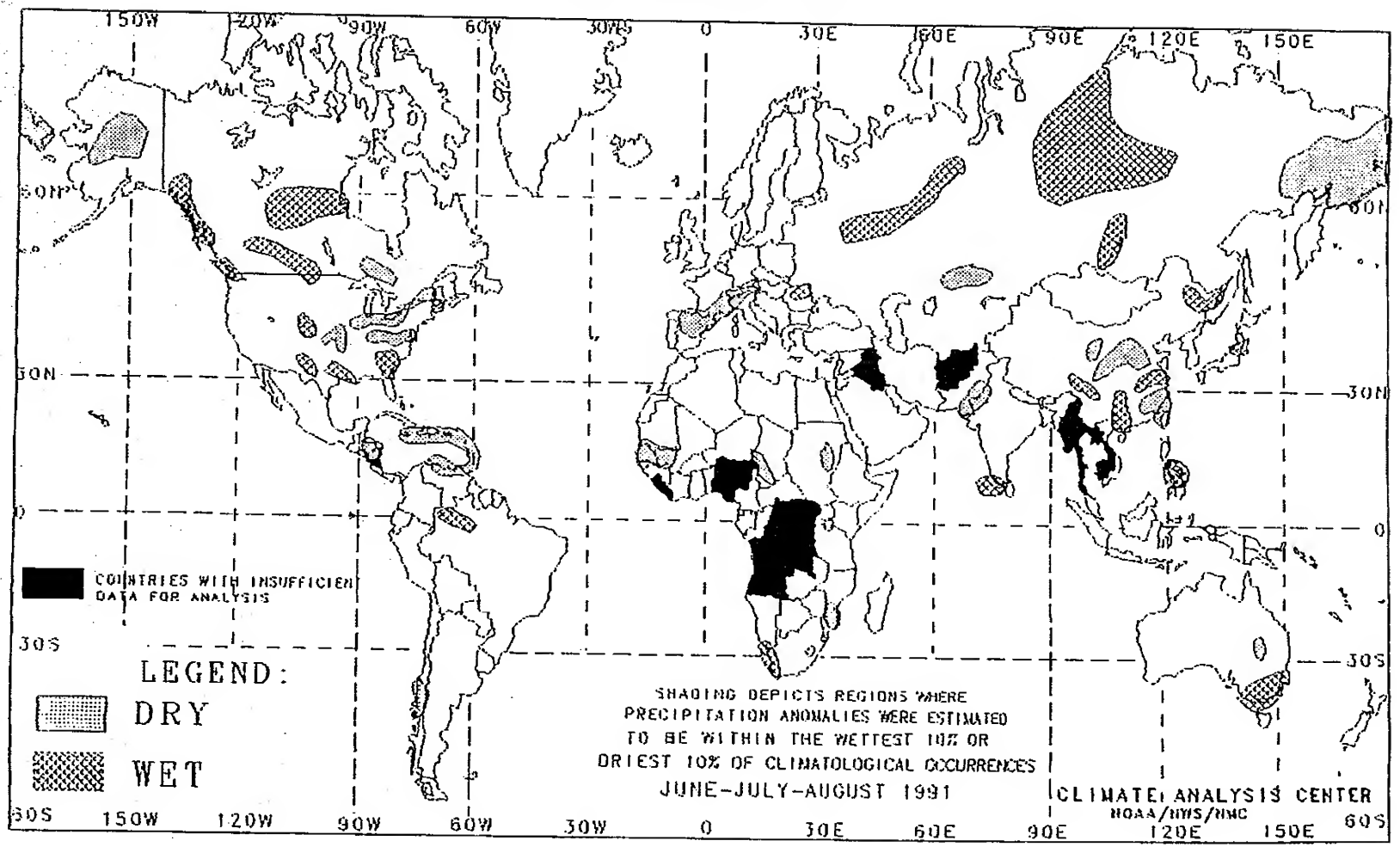
Temperature anomalies are not depicted unless the magnitude of temperature departures from normal exceeds 1.5°C.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of three month temperature anomalies. Caution must be usdd in relating it to local conditions, especially in mountainous regions.

3–MONTH GLOBAL PRECIPITATION ANOMALIES

JUNE – AUGUST 1991

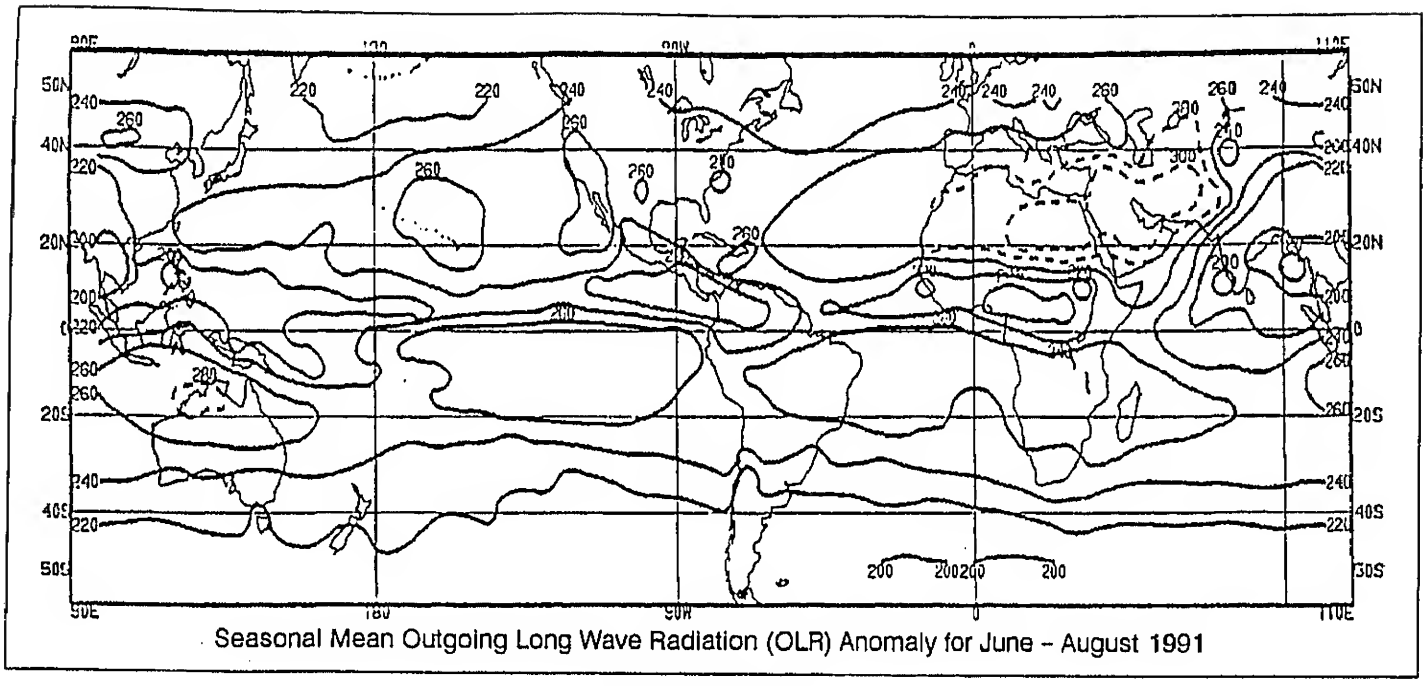


The anomalies on this chart are based on approximately 2500 observing stations for which at least 81 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the three month period is less than 50 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total three month precipitation exceeds 125 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of three month precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

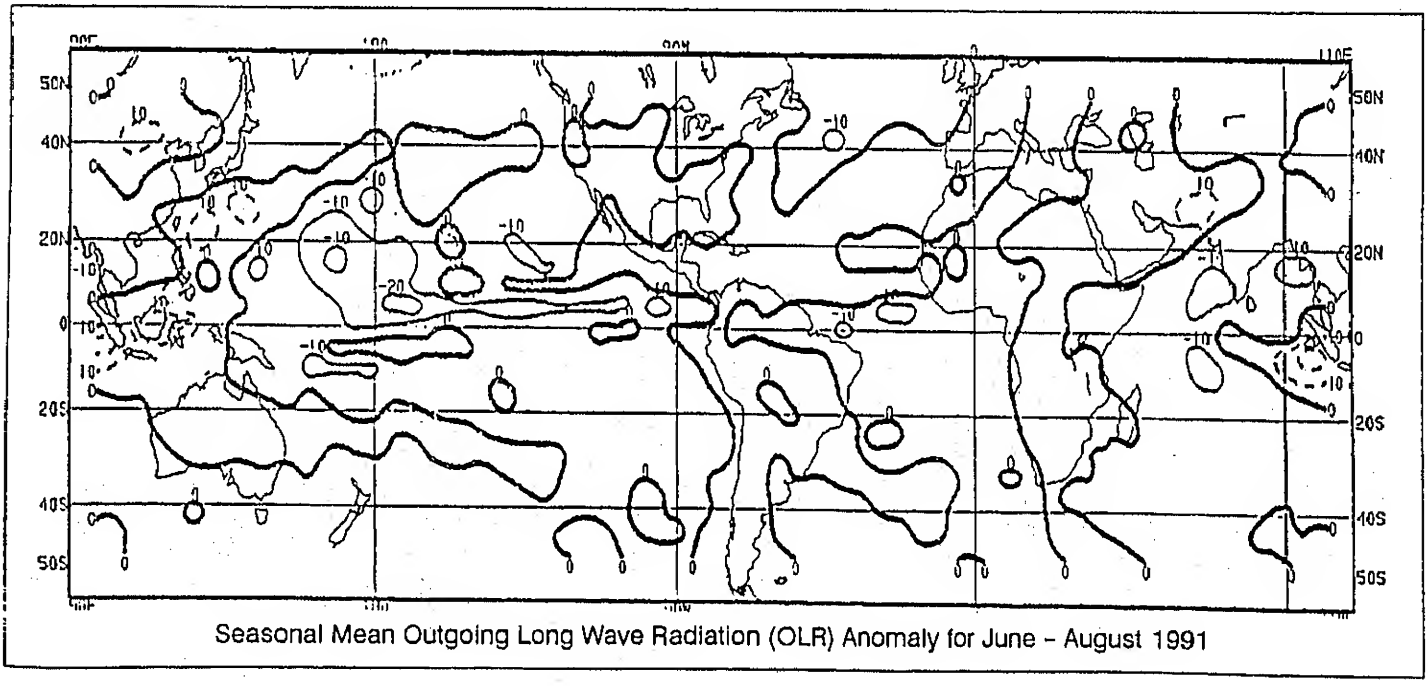


Seasonal Mean Outgoing Long Wave Radiation (OLR) Anomaly for June - August 1991

EXPLANATION

The mean seasonal outgoing long wave radiation (OLR) as measured by the NOAA-9 AVHRR IR window channel by NESDIS/SRL (top). Data are accumulated and averaged over 2.5° areas to a 5° Mercator grid for display. Contour intervals are 20 Wm^{-2}, and contours of 280 Wm^{-2} and above are dashed. In tropical areas (for our purposes 20°N - 20°S) that receive primarily convective rainfall, a mean OLR value of less than 200 Wm^{-2} is associated with significant monthly precipitation, whereas a value greater than 260 Wm^{-2} normally indicates little or no precipitation. Care must be used in interpreting this chart at higher latitudes, where much of the precipitation is non-convective, or in some tropical coastal or island locations, where precipitation is primarily orographically induced. The approximate relationship between mean OLR and precipitation amount does not necessarily hold in such locations.

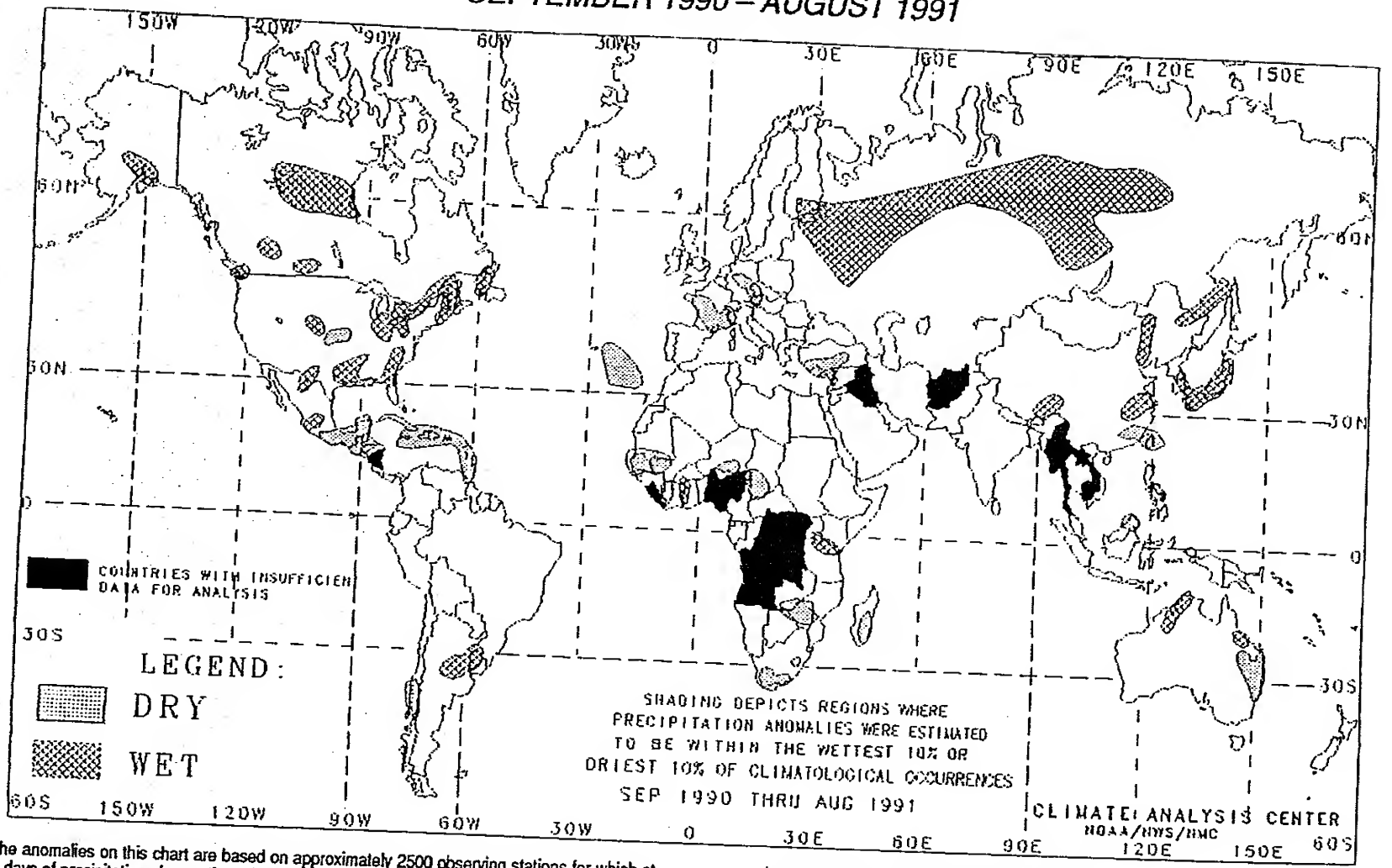
The mean monthly outgoing long wave radiation anomalies (bottom) are computed as departures from the 1979 - 1988 base period mean. Contour intervals are 15 Wm^{-2}, while positive anomalies (greater than normal OLR, suggesting less than normal cloud cover and/or precipitation) are dashed and negative anomalies (less than normal OLR, suggesting greater than normal cloud cover and/or precipitation) are solid .



Seasonal Mean Outgoing Long Wave Radiation (OLR) Anomaly for June - August 1991

12–MONTH GLOBAL PRECIPITATION ANOMALIES

SEPTEMBER 1990 – AUGUST 1991



The anomalies on this chart are based on approximately 2500 observing stations for which at least 350 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the twelve month period is less than 100 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total twelve month precipitation exceeds 250 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of twelve month precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

SPECIAL CLIMATE SUMMARY

ANALYSIS AND INFORMATION BRANCH
CLIMATE ANALYSIS CENTER, NMC
NATIONAL WEATHER SERVICE, NOAA

UPDATE ON THE 1991 INDIAN MONSOON SEASON

During the first months of the season, monsoonal rains across the Indian subcontinent typically expand northwestward, reaching central Pakistan around mid–July. By the beginning of September, the monsoon has usually begun its withdrawal from all but northeastern Pakistan and continues slowly retreating southeastward, reaching south–central India and southern Myanmar by late October and remaining only in southeastern Sri Lanka by the end of the year (Figure 1). In 1991, monsoonal rains were early and unusually heavy through southern and eastern sections of India and across Bangladesh; however, the northwestward advance of the rains abruptly stalled around mid–June, leaving central and northwestern India and most of Pakistan abnormally dry through July 13, 1991 [see the Update on the 1991 Indian Monsoon Season, Weekly Climate Bulletin #91/28, dated July 13, 1991, pp. 17 – 20, for more details].

The aforementioned trend of heavy rains through southern and eastern sections, with abnormally dry conditions farther north and west, generally continued during July 14 – September 21, 1991. In late July, unusually heavy rainfall, featuring weekly totals of 100–400 mm, briefly soaked southern and southeastern sections of Gujarat before renewed dryness accompanied the start of August. Farther north, only scattered light rainfall moistened most of west–central India and central and southern Pakistan during the period, bringing less than half of normal amounts to many areas. Portions of northeastern Pakistan and adjacent India (near Punjab) fared slightly better but still recorded primarily subnormal rainfall. Anomalously light rains also continued across Nepal and northern and central India during the latter half of July while seasonably heavy totals were reported along the western coastline, with weekly amounts exceeding 400 mm in spots. In sharp contrast, northern Bangladesh, and most of northeastern India, particularly Assam and Arunachal Pradesh, experienced severe flooding during the last half of July. More than 300 mm soaked some locations within one week, leaving over 3,000,000 individuals homeless and taking over 100 lives, according to press reports. Nearly 1000 square kilometers of crops were destroyed, and nearly 600 kilometers of roadway were washed out in Bangladesh alone.

As August commenced, floodwaters abated across eastern and northeastern India, although most locations continued to report heavier than normal rainfall. In Bangladesh, however, more flooding was reported as thousands were left homeless, nearly a dozen individuals lost their lives, and almost 300 additional square kilometers of crops were destroyed. Farther west, the end of July and the first week of August brought exceptionally heavy rains to parts of Maharashtra, sending the Wardha River out of its banks. The Nagpur region was most severely affected by the deluge as nearly 400 individuals lost their lives, according to press reports. The first half of August also brought the worst flooding in 60 years to portions of Myanmar (formerly Burma), where more than 1500 square kilometers of crops were ruined and more than 300,000 individuals were left homeless. Farther north and west, sporadic heavy rains generated flooding across Orissa around mid–month, and heavy rainfall finally arrived across northern India late in the month, where nearly 300 mm drenched parts of Uttar Pradesh, Haryana, Rajasthan, and New Dehli within three days. Despite these events, subnormal rainfall was recorded through most of southeastern, central, north–central, and western India and Pakistan during August while abundant rainfall continued through eastern India and Bangladesh. In addition, scattered weekly totals of 50–100 mm were reported near the Punjab of northeastern Pakistan and adjacent India.

The general trend of the previous few months continued into September. Another round of flooding took half a dozen lives, destroyed 25,000 dwellings, and ruined nearly 100 square kilometers of crops through Bangladesh. An additional 200,000 individuals were left homeless, and nearly 300 lives were lost after the floods due to epidemics of water–borne diseases. Much of Assam was also inundated as weekly totals approached 400 mm. The monsoon appeared to be withdrawing from northern and central India early, particularly along the western coast, where weekly amounts below 100 mm were measured since late August. Across the Punjab, an unusually late burst of rain (50–90 mm) moistened the region around mid–month while an exceptionally dry monsoon season continued across Nepal, where many locations recorded less than half of normal rainfall during May 1 – September 21, 1991 (front cover). The country is expecting a 20% drop in harvested rice due to the dryness, according to press reports.

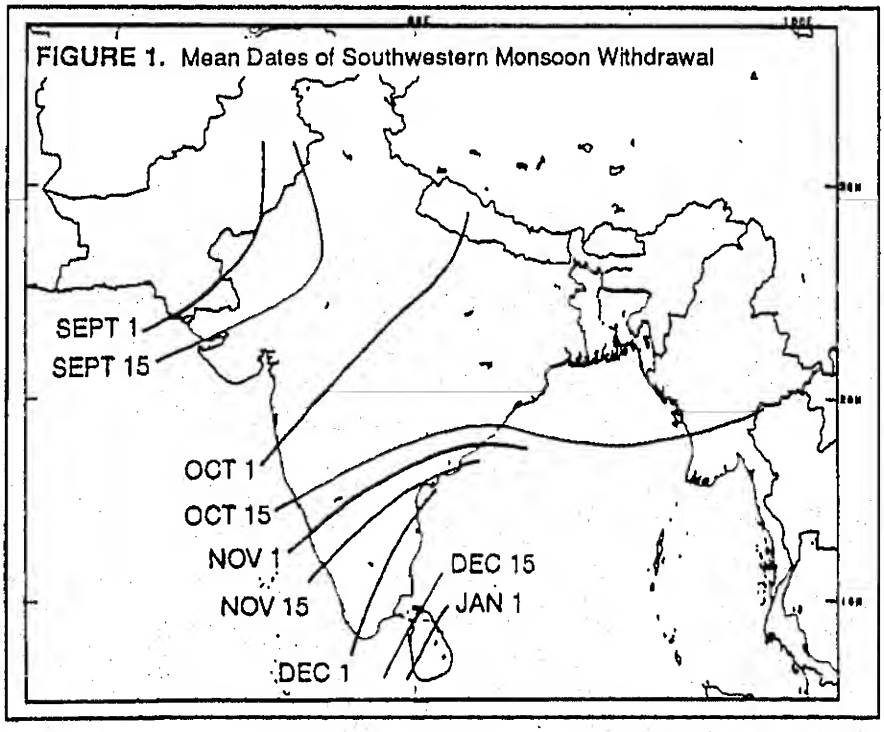


FIGURE 1. Mean Dates of Southwestern Monsoon Withdrawal

Through September 21, the 1991 monsoon brought a typically wide array of rainfall totals to the region, ranging from over 3500 mm along the southwestern coast of India to below 20 mm in central and southern Pakistan (Figure 2). Despite the flooding reported in portions of north–central and west–central India, seasonal totals of only 450–900 mm were reported, indicating a late start and an early end (so far) to the monsoon in these areas; however, according to press reports, the precipitation in primary agricultural regions was timely, and only a slight decrease in agricultural output from last year's abundant production is expected. Farther east, over 1000 mm soaked eastern India and probably Bangladesh (where reliable rainfall data are lacking), and more than 2300 mm drenched eastern Assam.

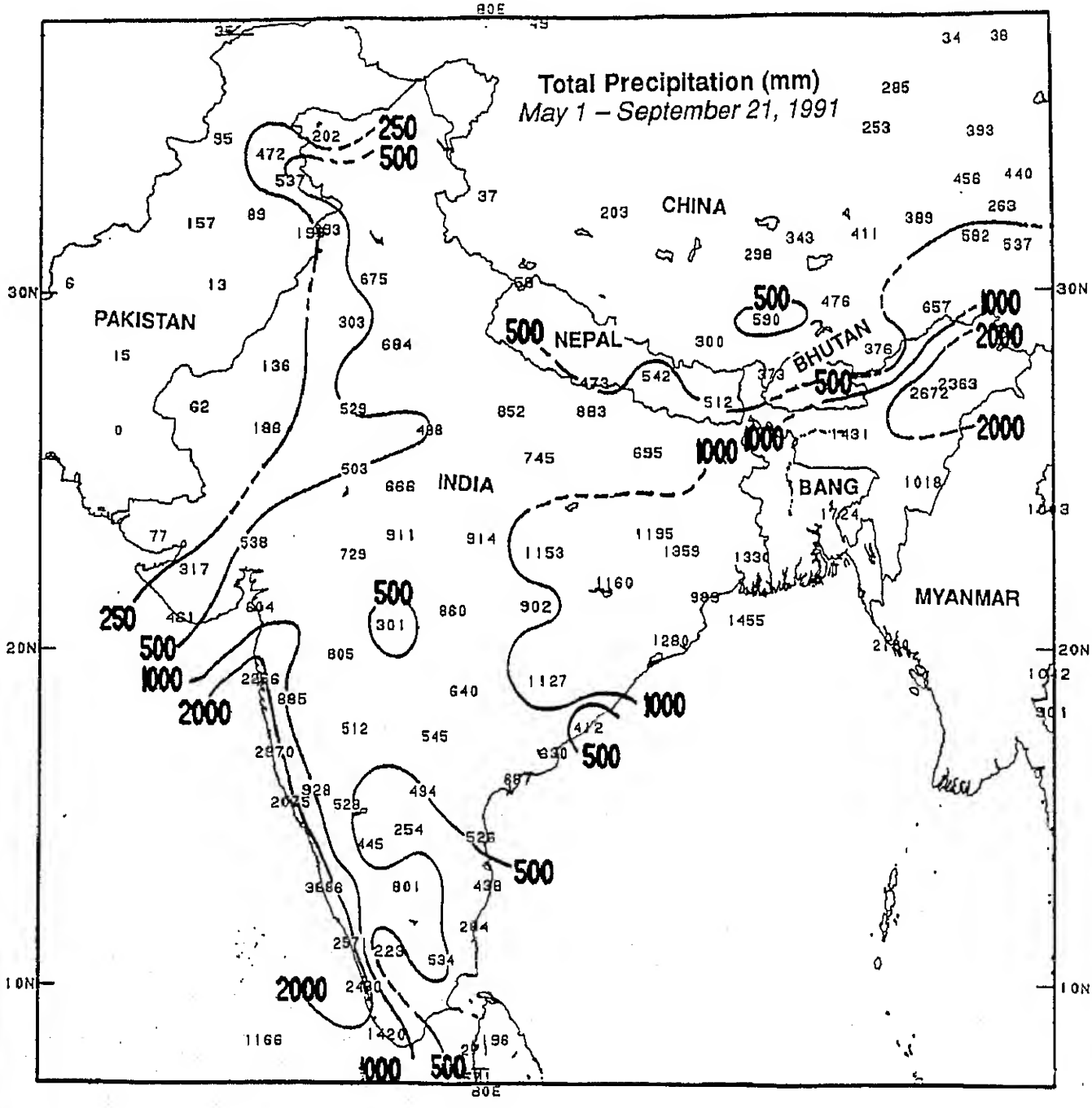


FIGURE 2. Total Precipitation (mm) During May 1 – September 21, 1991 (144) days. *A station had to report on 80% (115) days) or more of the days for inclusion. Isopleths drawn only for 250, 500, 1000, and 2000 mm. Seasonably heavy rain exceeding 2000 mm drenched India's northeastern corner and western coast during the period. In contrast, abnormally low totals below 250 mm were reported in most of Pakistan and extreme western India.*